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Non-Perturbative and Moments Methods Applied to the Morse Potential NATHAN WALSH, Fordham University, ERIC ASHENDORF, Kingsborough College of CUNY, JOHN TOLAND, Stevens Institute of Technology, VASSILIOS FESSATIDIS, Fordham University, JAY D. MANCINI, Kingsborough College of CUNY, SAMUEL P. BOWEN, Chicago State University — The well-known Morse potential has been well known to both physicists and quantum chemists for a number of years and has been used to model the behavior of diatomic molecules. Explicitly it may be written as

$$V(r) = D_e \left(e^{-2a(r-r_e)} - 2e^{-a(r-r_e)} \right) + D_e$$

where r is the inter-atomic separation, r_e is the (equilibrium) bond length and D_e is the depth of the potential well. The width of the well is given by $a^2 = k_e/2D_e$ with k_e the effective spring constant. Here we wish to study both the ground state energy (using both the Connected Moments Expansion and the Generalized Moments expansion) as well as the entire spectrum using a Lanczos scheme. Our results will be compared with other well-established results.

Vassilios Fessatidis
Fordham University

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